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SM8

Instruction Manual

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SM8

Instruction Manual

STROBOSCOPE SM8

ISSUE 2

JULY 1973

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PREFACE

DAMAGE IN TRANSIT

Unpack the equipment and examine it thoroughly to ascertain whether any damage has occurred in transit. Report immediately any such damage to the agent or manufacturer. Retain the four rubberized packing surrounds, should a return to manufacturer be necessary.

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All goods manufactured by the Company are guaranteed to the extent hereafter mentioned against defects arising from faulty material or workmanship subject to the goods not having suffered maltreatment or interference. The Company's liability under this guarantee is limited to replacing any part or parts found defective within a period as laid down in Company instructions after the date of delivery or installation.

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Descriptive matter,illustrations,dimensions and weights issued by the Company are typical and shall not be held as binding.
The Company reserves the right to alter patterns and designs without notice.

LIST OF AMENDMENTS

Al.No.	By Whom	Date

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LIST OF SECTIONS

		Page No.
SECTION 1	SPECIFICATION	1.1
SECTION 2	GENERAL INFORMATION	2.1
SECTION 3	INSTALLATION AND OPERATION	
	Preliminary Checks	3.1
	Storage	3.1
	Operating Power Source	3.1
	Equipment List	3.1
	Connections	3.1
	Power Lead	3.1
	Signal Connector	3.1
	Summary of Controls and Indicators	3.2
	Operating Instructions	3.2
	Internal Trigger Mode	3.2
	Triggering from an External Contactor Mechanism	3.3
	Triggering from an External Signal	3.4
	Hand Probe Operation	3.4
	Calibration Check	3.5
SECTION 4	CIRCUIT DESCRIPTION	
	Introduction	4.1
	Internal Trigger Mode	4.1
	External Trigger Mode	4.2
	Contact Closure Method	4.2
	Applied Signal Method	4.2
	Hand Probe Input	4.2
	Lamp Trigger Generation	4.3
	Calibration Network	4.4
	Power Supplies	4.4

SECTION 5 MAINTENANCE

Introduction 5.1
Fault Diagnosis 5.1
Preventive Maintenance 5.1
Cleaning 5.1
Visual Inspection 5.1
Performance Checks 5.3
Test Equipment 5.3
Supply Check 5.3
Pulse Width Check 5.3
Setting the Ranges 5.4
Setting the Meter 5.4
Meter Linearity Check 5.4
Stability Check 5.4
Flash Operation Check 5.4
External Trigger Check 5.6
Probe Supply Check 5.6

SECTION 6 COMPONENTS LIST

Ordering Information 6.1
Components List Table 6.1 6.2

CIRCUIT AND COMPONENT LAYOUT DIAGRAMS

Fig. No.

P.C. Board No.1 - Component Layout 1
P.C. Board No.2 - Component Layout 2
P.C. Board No.3 - Component Layout 3
P.C. Board No.4 - Component Layout D 27509 4
Stroboscope SM8 - Circuit Diagram E 26340 5

SECTION 1

SPECIFICATIONS

RANGES:	3 ranges: (a) 50-250 f.p.s. (3000 rev/min to 15000 rev/min) (b) 20-150 f.p.s. (1200 rev/min to 6000 rev/min) (c) 3-25 f.p.s. (180 rev/min to 1500 rev/min)
TRIGGER INPUTS:	(a) Internal trigger. (b) External trigger. *(i) External signal* *(ii) Contact closure* *(iii) Hand probe*
EXTERNAL INPUT:	2.5 V p-p to 15 V p-p (pulse, sinewave or squarewave).
INPUT IMPEDANCE (EXTERNAL INPUT):	4.7 kΩ (d.c. coupled)
ACCURACY:	± 2% of meter f.s.d.
LAMP:	(a) Type: SP501 (b) Power: 15 Watts
CALIBRATION SIGNAL:	Internally generated 100 Hz (twice line frequency).
FUSE (MAINS):	750 mA on 240V supply, slow-blow.

POWER REQUIREMENTS:

(a) Voltage: 110V or 240V r.m.s.

(b) Frequency: 50 Hz to 60 Hz

(c) Power Consumption: 80 VA (approx.)

DIMENSIONS:

(a) MAIN UNIT:

(i) Length: 21.3 cm (8 9/16 in).

(ii) Width: 20.8 cm (8$\frac{1}{4}$ in).

(iii) Depth: 20.3 cm (8 in).

(b) LAMP HOUSE:

(i) Diameter: 11.9 cm (4$\frac{1}{2}$ in).

(ii) Arm extension length from: 2.5 cm to 12 cm (1 in to 4$\frac{3}{4}$ in).

(iii) Cord extension length: 3.6 cm (12ft.) approx.

AMBIENT TEMPERATURE:

+ 25 °C ± 10 °C

SECTION 2

GENERAL INFORMATION

1.1 The Stroboscope SM8 is designed to enable observation of rotating or reciprocating machinery at speeds between 180 revolutions per minute and 15000 revolutions per minute. This is equivalent to flash rates between 3 flashes per second to 250 flashes per second.

1.2 Solid state techniques have been used throughout the instrument to achieve high performance, long-term reliability and low power consumption.

1.3 A calibrated meter indicates the rate in terms of flashes per second (f.p.s.) and the equivalent shaft speed in revolutions per minute (rev/min). The complete range of the instrument is covered in three steps as selected by a range switch:

(a) 250 f.p.s./15000 rev/min position: This covers the range 50 Hz to 250 Hz or 3000 rev/min to 15000 rev/min.

(b) 100 f.p.s./6000 rev/min position: This covers the range 20 Hz to 100 Hz or 1200 rev/min to 6000 rev/min.

(c) 25 f.p.s./1500 rev/min position: This covers the range 3 Hz to 25 Hz or 180 rev/min to 1500 rev/min.

1.4 To increase the flexibility in use, the lamp house, which projects from the main unit can be withdrawn and swivelled in any plane. By unclipping the side panel (which is used as the lamp stand, see Fig. 2.1B) the lamp house can be detached and used as a free-standing unit, up to a distance of 12 feet away.

1.5 The circuit is so arranged that by suitable switching the lamp can be made to flash by:

(a) Internal trigger.

(b) External input signals.

(c) External contact closure.

(d) Hand probe (light contrast activating a photo-electric cell).

1.6 The accuracy of the rate meter can be checked by a built-in calibrator, switched-in by a push-button CAL switch.

A SIDE PANEL CLIPPED INTO POSITION

B SIDE PANEL UNCLIPPED TO PRESENT A FREE-STANDING LAMP UNIT

FIG. 2.I STROBOSCOPE SM8

SECTION 3

INSTALLATION AND OPERATION

1. PRELIMINARY CHECKS

1.1 Storage: If the instrument has been in store for a prolonged period, check for evidence of dampness, particularly inside the lamp house, before attempting to switch-on. Make certain that the instrument is correctly set for the local power source.

1.2 Operating Power Source: The stroboscope can be operated from any power source within the range 110V to 250V, 50 Hz to 60 Hz. To alter the power setting, the links on the primary of the mains transformer T1 should be reconnected.

1.3 Equipment List: The following items comprise the stroboscope package:

(a) Stroboscope SM8

(b) External Input Plug (PL1), Type Mas 6, (pt no. AS0225) - 1-Off

(c) Mains Fuse, 750 mA - 1-Off

(d) Instruction Manual 1-Off

(e) Hand Probe (optional) - 1-Off

2. CONNECTIONS

2.1 Power Lead

Wire Colour	Function
Brown	Live
Blue	Neutral
Green/Yellow	Earth

2.2 Signal Connector PL1

Pin No.	Function
1	Linked to pin 5
2	+2.2V Probe Light Supply (Hi)
3	+20V Probe Supply (Hi)
4	+2.2V Probe Light Supply (Lo)
5	Linked to pin 1
6	External Input (Hi)
Connector Shell	External Input (Lo)/+20V Probe supply (Lo)/earth.

NOTE: The +2.2V probe light supply is only present when the stroboscope has been supplied with a hand probe.

3. SUMMARY OF CONTROLS AND INDICATORS

3.1 The controls and indicators are identified as follows:

(a) Supply/Range Selector: A 4-position switch that connects the power source to the instrument at all positions other than OFF. The 3 other positions are:

(i) 250 Hz/15000 rev/min. This covers the range 50 Hz to 250 Hz or 3000 rev/min to 15000 rev/min.

(ii) 100 Hz/6000 rev/min. This covers the range 20 Hz to 100 Hz or 1200 rev/min to 6000 rev/min.

(iii) 25 Hz/1500 rev/min. This covers the range 3 Hz to 25 Hz or 180 rev/min to 1500 rev/min.

(b) Internal Trigger Frequency Control: A knob located beneath the carrying handle, operable on the internal trigger mode only. It interpolates between settings of the Supply/Range Selector, and is used to determine the speed of the workpiece being observed.

(c) Input Socket SKT 1: Accepts either an input plug for use on external mode or the plug for the hand probe. Pin/Function details are given in Para 2 of this section. When a plug is inserted the internal trigger signal is interrupted.

(d) Rate Meter M1: Calibrated in f.p.s. and rev/min used to indicate the speed of rotation of the workpiece or the flash rate of the lamp.

(e) CAL 100 Hz: When pressed, a 100 Hz calibration signal is applied to the lamp trigger circuit in place of the normal trigger signal to check the accuracy of the instrument, on all ranges.

4. OPERATING INSTRUCTIONS

4.1 Internal Trigger Mode

4.1.1 To ascertain the speed of a rotating or reciprocating workpiece:

(a) Place the lamp at a point facing the workpiece. This position may have to be altered for the best results when flashing begins. The lamp house can be swivelled or withdrawn from the main unit where space is restricted, by slackening the knurled locking ring around the lamp house shaft. If required, the side panel through which the shaft projects can be unclipped and used as a stand. This allows the lamp house to be moved away from the main unit up to a distance of 12 feet.

(b) Select each range in turn (the instrument is switched-on by the same operation) and adjust the Internal Trigger Frequency control until a single image is obtained (i.e. the workpiece appears to stand still).

NOTE: False readings of workpiece speed will be obtained if the flash rate is a multiple of the shaft speed (i.e. with double strobing, a mark such as a keyway will appear twice, 180° apart, due to the lamp flashing twice per revolution). Alternatively, if the flash rate is half the shaft speed one stationary image will appear due to the one flash per two revolutions. To obtain a true reading therefore, when the speed of the shaft is not known, the flash rate should be set to the highest speed at which a single image is obtained.

CAUTION

The front panel may become hot during a long, continuous operation. Do not touch or place close to materials having a low melting point.

4.2 Triggering from an External Contactor Mechanism.

4.2.1 To flash the lamp in synchronism with the repetition rate or revolution of a workpiece, employing a pair of mechanically operated electrical contacts, the contacts should be coupled to the workpiece such that they momentarily close once per revolution or cycle of movement. Then proceed as follows:

(a) Connect each contact to a length of wire.

(b) Connect the loose wire ends, one to pin 6 and one to the plug shell on plug PL 1 (supplied). Ensure that pins 1 and 5 of PL 1 are linked.

(c) Insert PL 1 into socket SK 1 and set the Supply/Range Selector to 250.

(d) The lamp should now flash each time the contacts close, the repetition rate being indicated on the meter.

CAUTION

If there is too much contact bounce, the lamp may fail to fire correctly, and in extreme instances show an orange glow. This condition seriously affects the life of the lamp and the circuit is designed to avoid this under normal circumstances. Should this occur however, switch-off the stroboscope immediately and allow at least 30 seconds before resuming operation.

4.3 Triggering from an External Signal.

4.3.1 To synchronise the flash with the movement or rotation where the rotation speed (or repetition rate) varies, the output from a transducer should be connected as follows:

(a) Connect the transducer output to pins 6 (I/P Low) of the external signal plug PL 1 (supplied), and insert the plug into socket SK 1.

NOTE: To obtain satisfactory triggering the amplitude of the signal should be between 2.5 V p-p and 15 V p-p.

(b) Set the Supply/Range Selector to cover the highest repetition rate likely to be encountered on a particular test.

(c) Read off the speed indicator on the meter.

4.4 Hand Probe Operation

4.4.1 The hand probe is employed under the following conditions

(a) When it is required to measure repetition (or revolution) rates of a workpiece which cannot be mechanically coupled (i.e. fitted with contacts) due to loading effects.

(b) When the workpiece is inaccessible to the lamp.

(c) When the ambient light conditions are too bright for the flash to have effect.

4.4.2 To operate the hand probe, proceed as follows:

(a) Plug the hand probe connector into socket SK 1.

(b) Set the Supply/Range Selector to the appropriate range and note that the light in the hand probe lights-up. Adjust the fine control to the exact setting.

(c) Paint a white marker on the moving part of the workpiece and direct the hand probe lamp at it. As the workpiece revolves (or vibrates), the white mark reflects the light once per revolution to the photo-cell in the hand probe.

4.4.3 Accuracy of measurements at slow speeds can be improved by increasing the number of markers painted on the workpiece. For example, if ten markers were painted equidistant on a rotating disc, the lamp would flash 10 times per revolution. The speed indicated on the meter, divided by 10, would then be the true revolution rate.

4.4.4 To increase contrast, the background onto which the white marker is painted, can be painted matt black.

4.5 Calibration Check

4.5.1 To verify the accuracy of the stroboscope:

(a) Check the mechanical zero of the rate meter.

(b) Select the 25 Hz/1500 rev/min range.

THE CAL 100Hz PUSHBUTTON CANNOT BE USED TO CALIBRATE THE 25Hz/1500 rev/min RANGE

(c) Press the CAL 100 Hz push-button and check that the meter reads full scale ± 2%.

(d) Select the 100 Hz/6000 rev/min range.

(e) Press the CAL 100 Hz push-button and check that the meter reads full scale ± 2%

(f) Select the 250 Hz/15000 rev/min range.

(g) Press the CAL 100 Hz push-button and check that the meter reads 100 Hz ± 2% of full scale.

4.5.2 If the stroboscope does not perform to within the above limits, refer to the performance checks given in Section 5 Maintenance.

SECTION 4

CIRCUIT DESCRIPTION

1. INTRODUCTION

1.1 The circuit for the stroboscope is divided over four p.c. boards, as follows:

(a) printed-circuit board No. 2 contains a constant current generator, a transistorised uni-junction stage, and a trigger stage, which feeds:

(b) printed-circuit board No. 1 containing a monostable stage and an emitter-follower buffer stage with a silicon controlled rectifier, this feeds:

(c) printed-circuit board No. 3 on which is mounted a pulse transformer, located in the lamp-house with lamp V1,

(d) printed-circuit board No. 4 fitted into the hand probe containing a photo-cell stage and light LP1.

(e) Printed-circuit board No. 1 also contains the rectifying and smoothing components for the ±370V and +20V d.c. supplies, the lamp capacitors, and the rectifying and smoothing components for the probe light supply.

1.2 The instrument can operate in any one of two modes as follows:

(a) Internal trigger.

(b) External trigger. This can be derived from three sources:

(i) a contact closure or,

(ii) an applied signal or,

(iii) the hand probe.

2. INTERNAL TRIGGER MODE

2.1 The internal trigger is generated by a transistorised unijunction oscillator stage on P.C. Board No. 2 formed by the constant current generator TR5 working into transistors TR7 and TR8. Three frequency ranges are switched by SW1, poles c and d and are as follows:

(a) 50 - 250 Hz (b) 20 - 100 Hz (c) 3 - 25 Hz

NOTE: The lower figure quoted on each range is only an approximation, and varies slightly with each instrument.

2.2 The selected capacitor/resistor network working with transistor TR5 produces a perfect linear sawtooth which is fed from TR5 collector, via the jack contacts at SKT 1 to TR7 emitter on p.c. board No. 1. As the selected capacitor charges, a point is reached where the unijunction stage TR7-8 switches-on. The selected capacitor is suddenly discharged and resistor R30 is shorted producing a pulse at TR9 (a capacitively fed trigger stage). The slope of the saw tooth and thus the frequency is adjusted by potentiometer RV1. The output is fed to the monostable stage TR3 and TR4.

3. EXTERNAL TRIGGER MODE

3.1 Contact Closure Method

3.1.1 The instrument can be triggered by connecting switch contacts (e.g. a car contact breaker) across the input pins 6 and 7 on PL1, with pins 1 and 5 linked. When connected into socket SKT 1 the small jack contacts are opened, disconnecting TR5 output.

3.1.2 With the switch contacts opened, transistor TR6 is saturated, holding the emitter of TR7 low, via the linked pins 1 and 5 of PL1. A capacitor (0.33 µF) is connected across R26 and earth to prevent spurious triggering of TR6 from noisy contacts. When the contacts are closed, TR6 is cut off. With the contacts switching between states, a train of pulses is applied to TR9 base at the frequency of the switching contacts. The output of TR9 is fed to the monostable stage TR3 and TR4 (see para. 4.1).

3.2 Applied Signal Method

3.2.1 The signal input, which is applied across pins 6 and 7 (shell) on PL1/SKT1 can be a sinewave, square wave or a pulse, with a minimum amplitude of 2.5 volts p-p (d.c. coupled into 4.7k). The signal is fed to the base of TR6 which is switched off on the negative half-cycle.

3.2.2 The output of TR6 is fed via pins 1 and 5 (PL1/SK1) and SW26 to TR7 emitter. A train of pulses appears at TR9 base at the frequency of the input signal. TR9 output is applied as trigger input to the monostable stage TR3 and TR4 (see para. 4.1)

3.3 Hand Probe Input

3.3.1 The hand probe input is derived from pulses of reflected light applied to the photo-cell TR10, located on p.c. board no. 4 in the hand probe assembly. The output at TR10 collector is fed via capacitor C25 and pin 6 of PL1/SK1 to the base of TR6 which is cut-off with each pulse of reflected light. From here, the circuit action similar to the applied signal method.

4. LAMP TRIGGER GENERATION

4.1 The output of TR9 collector is used to trigger the monostable circuit formed by transistor TR3 and TR4. The monostable generates pulses of a fixed width, with a mark/space ratio determined by the frequency of the trigger input. With an internal trigger, this is varied by the adjustment of RV1. The mark/space ratio determines the voltage level at TR4 collector which is indicated as a frequency by meter M1.

4.2 When switch SW1 is switched between ranges, capacitors C13 and C14 are switched, in turn, across capacitor C12 to increase the pulse width at the lower frequencies, so that full scale is maintained for each range on the meter M1.

4.3 When the output pulse at TR3 is positive, the gate of SCR1 goes positive (fed via TR2, junction of R7/8 and d.c. blocking capacitor C10). In this state, SCR1 is switched into heavy conduction, allowing capacitor C11 to discharge through T2 primary, at a high current rate.

4.4 If the pulse transformer T2 was not in circuit, the maximum current would be limited by R4. As T2 is present, however, a back e.m.f. is generated which drives the negative pole of SCR1, negative. This stops the avalanche effect of SCR1 and hence stops its conduction.

4.5 The pulse produced in the T2 primary winding is transformed into 6kV spikes in its secondary winding. When SCR1 ceases conduction, capacitor C11 recharges through R4.

4.6 When the lamp is in the 'unstruck' state, capacitors C5 and C6 are fully charged through R3 to 740V (approx). When the trigger pulse (6 kV spike) is applied to the lamp, the Xenon gas ionizes, using the energy in capacitors C5 and C6 to maintain ionization (i.e. they are discharged through the lamp). When the capacitors are almost discharged, de-ionization occurs, through lack of energy and then they re-charge through R3 in preparation for the next trigger pulse.

4.7 The value of R3 is critical because:

(a) If too low, insufficient energy would be available from the supply to maintain the lamp in the ionized state permanently.

(b) If too high, at the maximum trigger frequency, capacitors C5 and C6 would not be re-charged to a voltage high enough to maintain reliable striking.

4.8 At the lower frequencies the apparent brightness of each flash is greater at high frequencies because the energy within each flash has a longer time to dissipate between flashes. To maintain the lamp dissipation at a constant level, irrespective of trigger frequency, a CR network (capacitors C3-6 and resistors R2 and R3) is switched across the lamp (SW1, poles a and b) at the same time as the trigger input frequencies are selected. Resistor R2 is connected to maintain the unselected capacitors in a charged state, so that when range switching is performed serious arcing across the switch contacts is avoided.

4.9 The value of capacitor selected is determined by the formula:

$$W = \tfrac{1}{2} CV^2F.$$

Where: W = Mean watts dissipated
C = Value of capacitors in Farads
V = Total voltage across lamp
F = Maximum trigger frequency

At higher frequencies a lower value capacitance is used and vice-versa.

WARNING

High Voltages are present on the Pulse Transformer (6 kV) and lamp (750 V).

5. CALIBRATION NETWORK

5.1 The calibration network is formed by D14, D15, R34, R41 and SW3. The network is supplied from the 0-25V secondary winding of transformer T1 and a smoothed stabilised 100 Hz (twice mains frequency) output is produced at board (1) pin 53. When the CAL 100 Hz push-button is depressed, pole SW3B open circuits the trigger signal, while pole SW3A connects the 100 Hz calibration signal as input to the transistorised unijunction stage TR7 and TR8. In this state, the accuracy of the meter indication can be checked.

6. POWER SUPPLIES

6.1 With switch SW2 closed, the mains supply is connected, via fuse FS1, across the primary winding of transformer T1, causing neon N1 to glow. The d.c. supplies generated are as follows:

(a) ± 370 V d.c. (50 mA) for the lamp and pulse transformer

(b) + 20 V d.c. stabilised supply for the transistor circuitry

(c) + 2.2 V d.c. supply for light LP1 in the hand probe (if fitted).

6.2 The + 370 V d.c. supply is derived from the 25V - 0 - 25V winding of T1, rectified by the bridge circuit D1-4, and smoothed by C1, 2, with R1.

6.3 The + 20 V d.c. supply is derived from the 0-25V winding of T1, rectified by the bridge circuit D5-D8 and smoothed by C7. Stabilisation is obtained from Zener diode DZ9, controlling series stage TR1.

6.4 The + 2.2 V d.c. supply is derived from the 0-6.3 V winding. This circuit is only fitted to the stroboscope if a hand probe is supplied. The output is applied across pins 2 and 4 of socket SKT 1.

SECTION 5

MAINTENANCE

1. INTRODUCTION

1.1 This section contains information to assist in fault diagnosis and also contains notes on preventive maintenance and performance checks.

WARNING

High voltages (+6 kV and +830V) are present in the lamp house and +415V is present on board 1.

1.2 Ensure that the instrument is disconnected from the power source befor removing the outer casing.

2. FAULT DIAGNOSIS

2.1 The fault-finding chart on fig. 5.1, is intended as a general guide only. Assistance can be obtained from the Service Department, SE Laboratories (EMI) Ltd., North Feltham Trading Estate, Feltham, Middlesex. Tel. No. 01-890-1166.

3. PREVENTIVE MAINTENANCE

3.1 Cleaning

3.1.1 The unit should be cleaned as often as operating conditions require. Accumulation of dust in the unit can cause overheating and component breakdown. Dust on components acts as an insulating layer thus preventing efficient heat dissipation.

3.1.2 Thoroughly clean the inside and outside of the instrument. Remove the dust from inaccessible areas with low pressure, compressed air. Use alcohol applied with a brush to remove accumulations of dust or grease from connector contacts and component terminals. Clean the exterior of the instrument and the front panel with a mild detergent mixed with water, applying the solution with a soft, lint-free cloth.

3.2 Visual Inspection

3.2.1 The SM8 should be inspected occasionally for broken connections, loose broken or frayed wiring, dirty or pitted switch and connector contacts and cracked or broken printed circuit boards. Often, before a failure occurs, a deteriorating component can be located due to obvious discolouration, cracking or warping.

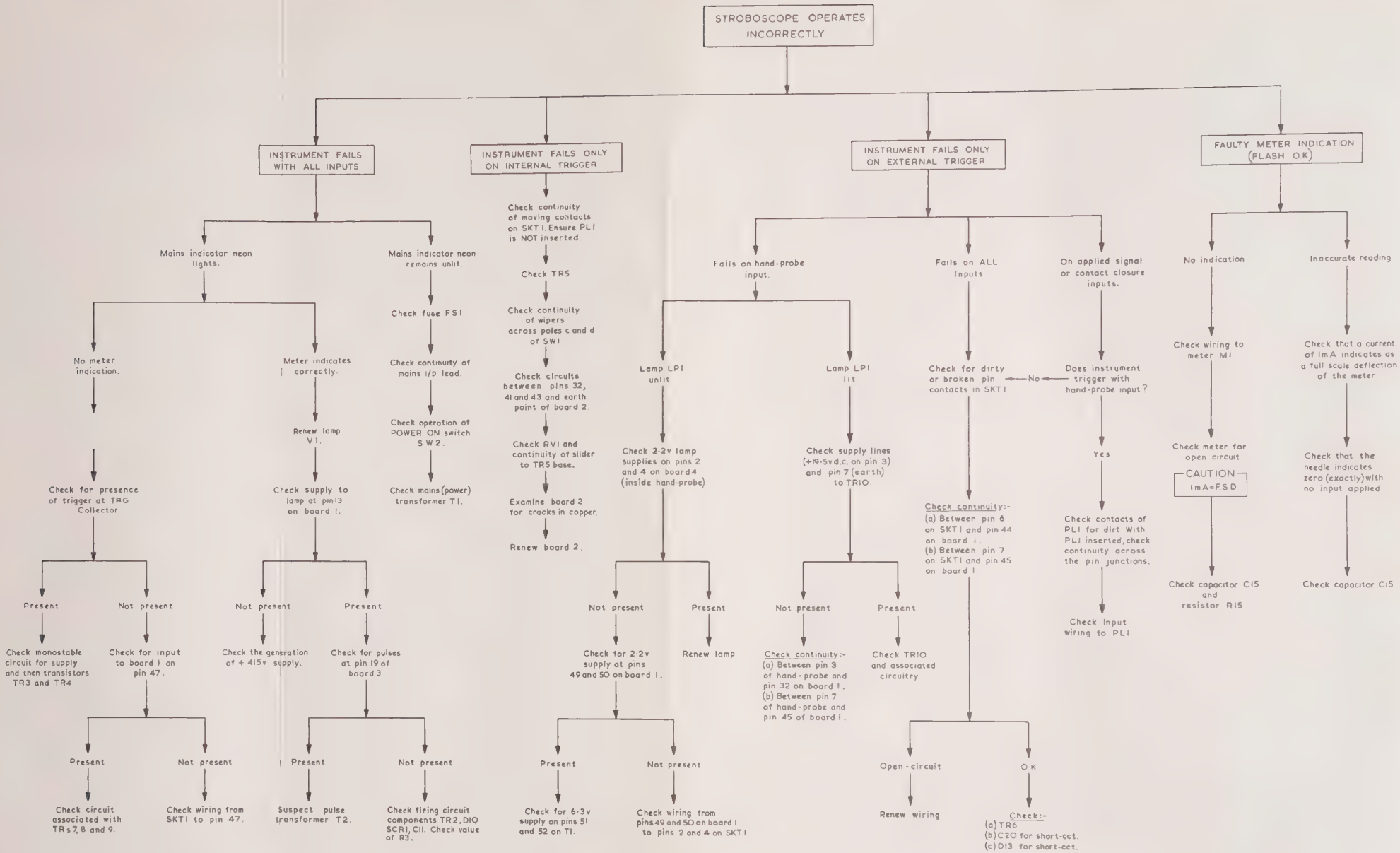

STROBOSCOPE OPERATES INCORRECTLY
INSTRUMENT FAILS WITH ALL INPUTS
INSTRUMENT FAILS ONLY ON INTERNAL TRIGGER
INSTRUMENT FAILS ONLY ON EXTERNAL TRIGGER
FAULTY METER INDICATION (FLASH O.K)
Mains indicator neon lights.
Mains indicator neon remains unlit.
No meter indication.
Meter indicates correctly.
Check fuse FS1
Check continuity of mains i/p lead.
Check operation of POWER ON switch SW2.
Check mains (power) transformer T1.
Renew lamp V1.
Check supply to lamp at pin 13 on board 1.
Check for presence of trigger at TRG Collector
Present
Not present
Check monostable circuit for supply and then transistors TR3 and TR4
Check for input to board 1 on pin 47.
Present
Not present
Check circuit associated with TRs 7, 8 and 9.
Check wiring from SKT1 to pin 47.
Not present
Present
Check the generation of +415v supply.
Check for pulses at pin 19 of board 3
Present
Not present
Suspect pulse transformer T2.
Check firing circuit components TR2, DIQ SCR1, C11. Check value of R3.
Check continuity of moving contacts on SKT1. Ensure PL1 is NOT inserted.
Check TR5
Check continuity of wipers across poles c and d of SW1
Check circuits between pins 32, 41 and 43 and earth point of board 2.
Check RV1 and continuity of slider to TR5 base.
Examine board 2 for cracks in copper.
Renew board 2.
Fails on hand-probe input.
Fails on ALL inputs
On applied signal or contact closure inputs.
Lamp LP1 unlit
Lamp LP1 lit
Check 2·2v lamp supplies on pins 2 and 4 on board 4 (inside hand-probe)
Check supply lines (+19·5v d.c. on pin 3) and pin 7 (earth) to TR10.
Check for dirty or broken pin contacts in SKT1
No
Does instrument trigger with hand-probe input?
Yes
Check continuity:-
(a) Between pin 6 on SKT1 and pin 44 on board 1.
(b) Between pin 7 on SKT1 and pin 45 on board 1.
Check contacts of PL1 for dirt. With PL1 inserted, check continuity across the pin junctions.
Check Input wiring to PL1
Not present
Present
Check for 2·2v supply at pins 49 and 50 on board 1.
Renew lamp
Not present
Present
Check continuity:-
(a) Between pin 3 of hand-probe and pin 32 on board 1.
(b) Between pin 7 of hand-probe and pin 45 of board 1.
Check TR10 and associated circuitry.
Present
Not present
Check for 6·3v supply on pins 51 and 52 on T1.
Check wiring from pins 49 and 50 on board 1 to pins 2 and 4 on SKT1.
Open-circuit
O K
Renew wiring
Check:-
(a) TR6
(b) C20 for short-cct.
(c) D13 for short-cct.
No indication
Inaccurate reading
Check wiring to meter M1
Check that a current of 1mA indicates as a full scale deflection of the meter
Check meter for open circuit
CAUTION
1mA=F.S.D
Check that the needle indicates zero (exactly) with no input applied
Check capacitor C15 and resistor R15
Check capacitor C15

FIG. 5.1 FAULT-FINDING CHART — SM8

3.2.2 Care must be taken when heat-damaged parts are located. Overheating is usually only a symptom of trouble. For this reason, it is essential to determine the actual cause of overheating before the heat-damaged part is renewed, otherwise, the damage may be repeated.

4. PERFORMANCE CHECKS

4.1 Test Equipment (Fig. 5.2A)

(a) A composite test rig comprising:

(i) Mains Variac and Mains Voltage Meter.
(ii) Photocell
(iii) A clamp to hold the lamp assembly in a fixed position in relation to the photocell.

(b) Frequency Meter (Timer/Counter SM 200 or similar)

(c) Signal Generator (Levell TG 150D or similar)

(d) Avometer Model 8 or 9

(e) Decade Resistor Box

(f) Double Beam Oscilloscope (EM 102 or similar)

(g) Dummy Probe as shown in fig 5.2 B

4.2 Supply Check

(a) With mains connected to appropriate mains voltage, switch the unit on and check that mains current does not exceed 300 mA r.m.s. at 240V or (600 mA r.m.s. at 120V)

(b) Check the d.c. voltages across components as follows:

Component	Voltage
C.1	415 V ± 10%
C.2	415 V ± 10%
C.4	830 V ± 10%
C.8	19.5 V ± 1V

4.3 Pulse Width Check

Using the test oscilloscope, check the positive pulsewidth at the emitter of TR2 to be:

Range	Pulsewidth
250 Hz	3 ms ± 10%
100 Hz	7 ms ± 10%
25 Hz	30 ms ± 10%

4.4 Setting the Ranges

(a) Connect the frequency meter and oscilloscope across the emitter of TR8 and the 0 V line.

(b) Select and fit resistors to obtain appropriate frequency on the three ranges as follows, with fine trigger control set for maximum frequency (fully clockwise).

Range	Select & Fit	To obtain at TR8
250 Hz	R.25	258 Hz to 265 Hz
100 Hz	R.24	103 Hz to 106 Hz
25 Hz	R.23	25.7 Hz to 26.4 Hz

(c) Check the range of the fine control to be not less than 5:1. For example, on the 250 Hz range, the minimum frequency should be less than 50 Hz.

4.5 Setting the Meter

(a) Select and fit resistors as listed below to obtain full scale deflection on the indicator as follows:

Range	Select & Fit	Indicated Frequency Reading
250 Hz	R.19	250 Hz ± 1%
100 Hz	R.18	100 Hz ± 1%
25 Hz	R.17	25 Hz ± 1%

4.6 Meter Linearity Check

(a) On each range, check the linearity of the meter, taking at least 2 readings over the range selected. The linearity of the indicated reading against the actual reading on the frequency meter should be within ± 2% of f.s.d.

4.7 Stability Check

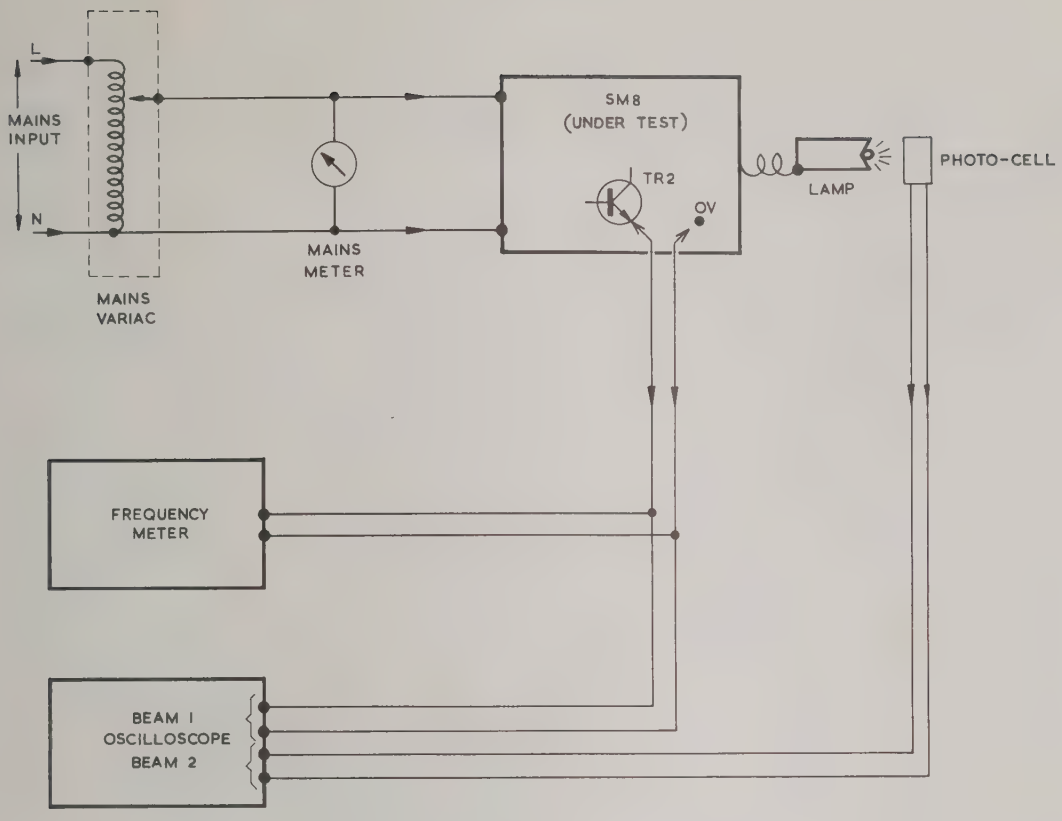
(a) Vary the mains supply by ± 10% and check the accuracy of the full scale reading is stable to within ± 2% of f.s.d.

4.8 Flash Operation Check

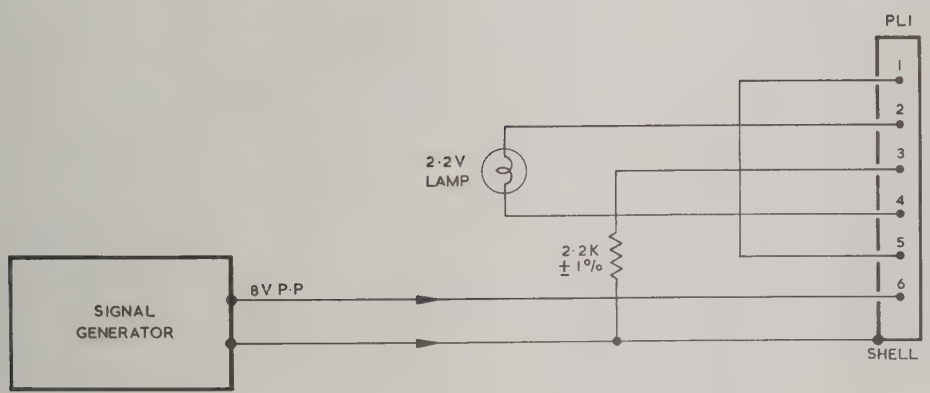
(a) Connect one beam of the Oscilloscope across the photo cell output and with lamp clipped on test gear, connect the second beam to the emitter of TR2.

(b) Check that the lamp flashes correctly over the full range by making sure that no pulse, as picked-up on photo cell is missing or misfiring. Check that the output as picked up on the photo cell is within ± 0.5% when compared with standard stroboscope.

(c) Vary the mains by ± 10% and check that lamp does not misfire or cease to operate.



A TEST RIG



B DUMMY PROBE

FIG. 5.2 TEST EQUIPMENT

4.9 External Triggering Check

(a) Connect the Signal Generator to the external trigger input socket, (set to 8 V p-p) and check that the lamp flashes up to full scale frequency on all three ranges. Check that the minimum input required for operation is less than 2.5 V peak to peak.

(b) Check that the fine trigger control has no effect when external triggering is used.

4.10 Probe Supply Check

(a) Connect the dummy probe (fig. 5.1B) into socket 1, check that the voltage across pin 3 (+) to chassis is 19.5 V d.c. ± 1 V.

(b) Check that the voltage across pins 2 and 4 is 2.2V ± 0.2V with the probe lamp on.

SECTION 6

COMPONENTS LIST

1. ORDERING INFORMATION

1.1 This section contains information for ordering replaceable parts. The components table (6.1) provides the circuit reference (if applicable), manufacturer, stock number, and description.

1.2 To order your replacement part, address the order to your local agent, or to:

SE Laboratories (EMI) Ltd., Service Department, North Feltham Trading Estate, Feltham, Middlesex, England.

Telephone: 01-890-1166

1.3 Specify the following information for each part:

(a) Model and serial numbers of the instrument.

(b) S.E.L. part number.

(c) Circuit reference.

(d) Description.

1.4 To order a part not listed, give the stock number and description of the main assembly listed and a complete description of the part required.

TABLE 6.I COMPONENTS TABLE

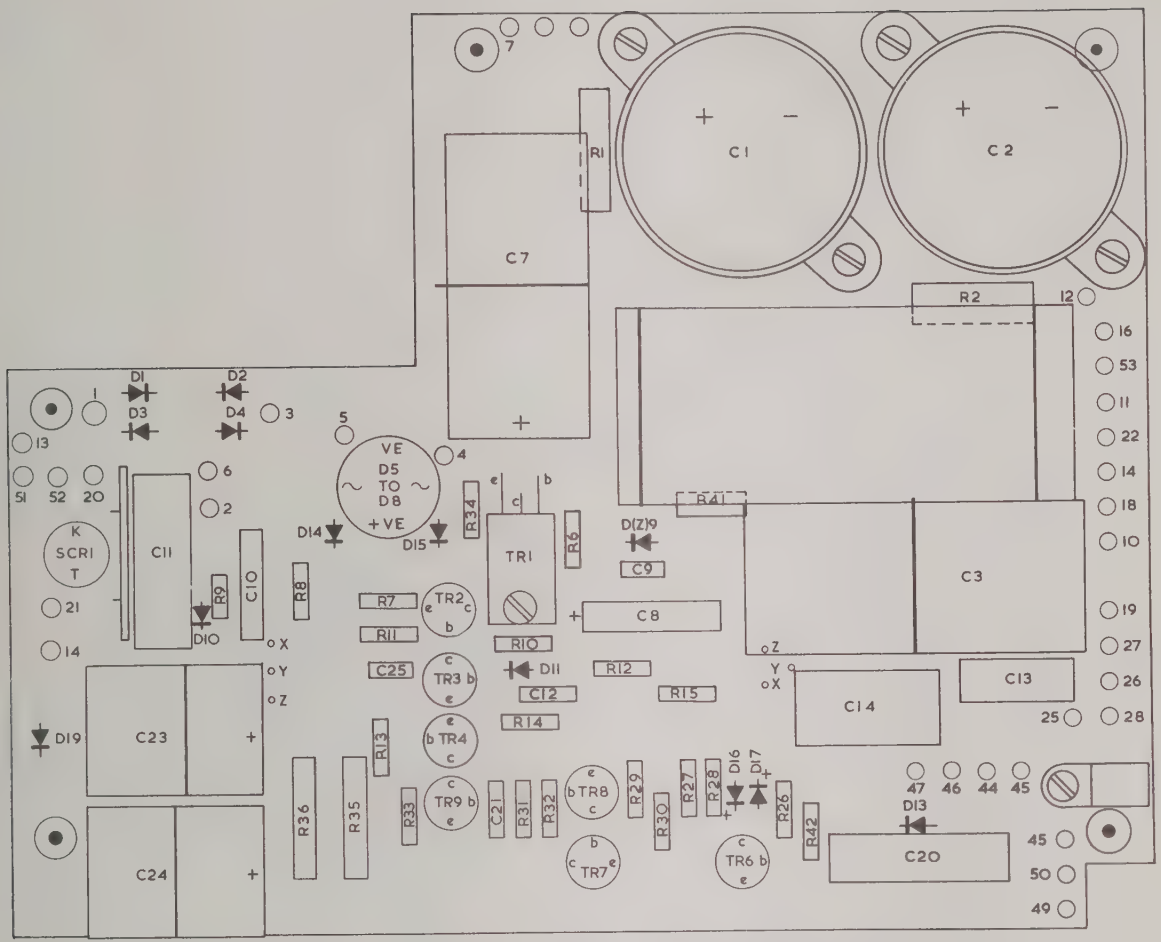
Cct. Ref.	S.E.L. Part No.	Manufacturer/Reference	Value	Tol ± %	Rating
		CAPACITORS (μF)			
C1	CS 30523	C.C.L., ER70S. H71	100		500V
C2	CS 30523	C.C.L., ER70S. H71	100		500V
C3		Dubilier, Bluecon 660M	0.47		1000V
C4		I.T.T., AF 454 K	1.0	20	1000V
C5	CS 30423	Dubilier, Bluecon 660M	0.15		1000V
C6	CS 30423	Dubilier, Bluecon 660M	0.15		1000V
C7		Mullard, 017-17221	220	+50,-10	40V
C8		Mullard, 016-16479	47	+50,-10	25V
C9		Erie, 811/T	0.1		30V
C10		Waycom, Wima,Tropyfol M	0.1	5	100V
C11		Waycom, Wima,Tropyfol F	0.15	20	400V
C12		Radio Resistor, D3B473	0.047	5	250V
C13		Waycom, Wima,Tropyfol M	0.068	5	160V
C14		Waycom, Wima,Tropyfol M	0.47	5	160V
C15		Mullard, C437AR/A4000	4000	+50,-10	2.5V
C16	CS 4857	Radio Resistor, D3D223	0.22	5	400V
C17	CS 4857	Radio Resistor, D3D223	0.22	5	400V
C18	CS 4853	Radio Resistor, D3D333	0.033	5	400V
C19	CS 30426	Radio Resistor, D3D224	0.22	5	250V
C20		Radio Resistor, D3B334	0.33	5	250V
C21	CS 30427	Radio Resistor, D3D103	0.01	10	250V
C22					
C23		Mullard, C437AR/G250	250	+50,-10	40V
C24		Mullard, C437AR/B3200	3200	+50,-10	4V
C25	CS 30211	Union Carbide	15.0	20	20V
C26	CS 30429	Union Carbide	47.0	20	6V
C27		Sufflex, HS	1000p	10	30V

Cct. Ref.	S.E.L. Part No.	Manufacturer/Reference	Value	Tol ± %	Rating
		DIODES AND RECTIFIERS			
D1	BS 2663	Westinghouse, S15M1			
D2	BS 2663	Westinghouse, S15M1			
D3	BS 2663	Westinghouse, S15M1			
D4	BS 2663	Westinghouse, S15M1			
D5		I.T.T. 96AAA			0.5A
D6		I.T.T. 96AAA			0.5A
D7		I.T.T. 96AAA			0.5A
D8		I.T.T. 96AAA			0.5A
D(Z)9	BS 2664	Hughes, HS 7200		5	
D10	BS 2045	Texas, 1N 914			
D11	BS 2045	Texas, 1N 914			
D12	BS 2045	Texas, 1N 914			
D13	BS 2045	Texas, 1N 914			
D14	BS 2045	Texas, 1N 914			
D15	BS 2045	Texas, 1N 914			
D16					
D17					
D18					
D19		Westinghouse, S1M1			
SCR1	BS 2662	R.C.A. 40379			
		RESISTORS (FIXED) Ω			
R1	DS 6503	Morganite, Type 0	220K	10	2W
R2	DS 32291	Morganite, Type W	180	10	1W
R3		Radio Resistor, LHS 50	4.7K	5	50W
R4		Radio Resistor, KKA11	8.2K	10	12W
R5		Radio Resistor, KKA11	15K	10	12W
R6		Radio Resistor, 5LCA0309	1.8K	5	¼W
R7		Radio Resistor, 5LCA0309	470	5	¼W
R8		Radio Resistor, 5LCA0309	1K	5	¼W
R9		Radio Resistor, 5LCA0309	1K	5	¼W

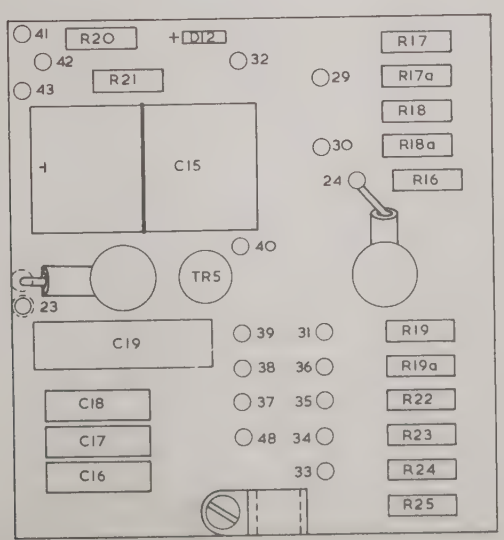
Cct. Ref.	S.E.L. Part No.	Manufacturer/Reference	Value	Tol ± %	Rating
R10		Dubilier, BTT	2.2K	5	½W
R11		Radio Resistor, 5LCA0309	15K	5	¼W
R12		Electrosil, TR5	82K	2	¼W
R13		Radio Resistor, 5LCA0309	12K	5	¼W
R14		Dubilier, BTT	2.2K	5	½W
R15		Radio Resistor, 5LCA0309	250	5	¼W
R16		Radio Resistor, 5LCA0309	240	5	¼W
R17		Radio Resistor, 5LCA0309	S.O.T.	5	¼W
R18		Radio Resistor, 5LCA0309	S.O.T.	5	¼W
R19		Radio Resistor, 5LCA0309	S.O.T.	5	¼W
R20		Radio Resistor, 5LCA0309	330	5	¼W
R21		Radio Resistor, 5LCA0309	56K	5	¼W
R22		Radio Resistor, 5LCA0309	24K	5	¼W
R23		Radio Resistor, 5LCA0309	S.O.T.	5	¼W
R24		Radio Resistor, 5LCA0309	S.O.T.	5	¼W
R25		Radio Resistor, 5LCA0309	S.O.T.	5	¼W
R26	DS 5731	Dubilier, BTT.	4.7K	10	½W
R27		Radio Resistor, 5LCA0309	270K	5	¼W
R28		Radio Resistor, 5LCA0309	5.6K	5	¼W
R29		Dubilier, BTT	2.2K	5	½W
R30		Dubilier, BTT	2.7K	5	½W
R31		Radio Resistor, 5LCA0309	3.3K	5	¼W
R32		Radio Resistor, 5LCA0309	180	5	¼W
R33		Radio Resistor, 5LCA0309	10K	5	¼W
R34		Dubilier, BTT	4.7K	10	½W
R35		Dubilier, BTA	12	10	1W
R36		Dubilier,BTA	12	10	1W
R37	DS 6291	Dubilier,BTT	4.7M	10	½W
R38	DS 5997	Dubilier,BTT	47K	10	½W
R39	DS 6277	Dubilier,BTT	2.2M	10	½W
R40					
R41		Radio Resistor, 5LCA0309	750K	5	¼W

Cct. Ref.	S.E.L. Part No.	Manufacturer/Reference	Value	Tol ± %	Rating
		RESISTORS (VARIABLE) Ω			
RV1		Colvern, Linear, CLR 3001/11S	2K		2W
		TRANSISTORS			
TR1		Texas, TIP 29			
TR2	BS 2516	Siemens, BC 168C			
TR3	BS 2516	Siemens, BC 168C			
TR4	BS 2516	Siemens, BC 168C			
TR5		National, BC 214			
TR6	BS 2516	Siemens, BC 168C			
TR7	BS 2371	Texas, 2N 3702			
TR8	BS 2516	Siemens, BC 168C			
TR9	BS 2516	Siemens, BC 168C			
TR10		BPX 25			
		MISCELLANEOUS			
SW1	C 27626	Switch Wafer, N.S.F.			
SW2	C 27626	Switch Wafer, N.S.F.			
SW3	QS 22280	Push-button, 2-pole, Rendar type PBS-1-C0			
T1	ES 8365	Transformer, Mains, SEL 5/336			
T2		Transformer, Trigger, A.E.G., Type Z S121.			
SKT1	AS 1193	Socket, 6-pin, Herschmann, Mab 6-Ri.			
PL1	AS 0225	Plug, 6-pin, Herschmann, Ma 6.			
M1	VS 27096	Meter, 1 mA f.s.d., M/C, d.c. Anders Elec., KYORITSU KM 86.			
N1	JS 14084	Neon, Red, 110V, Elkay Man.			

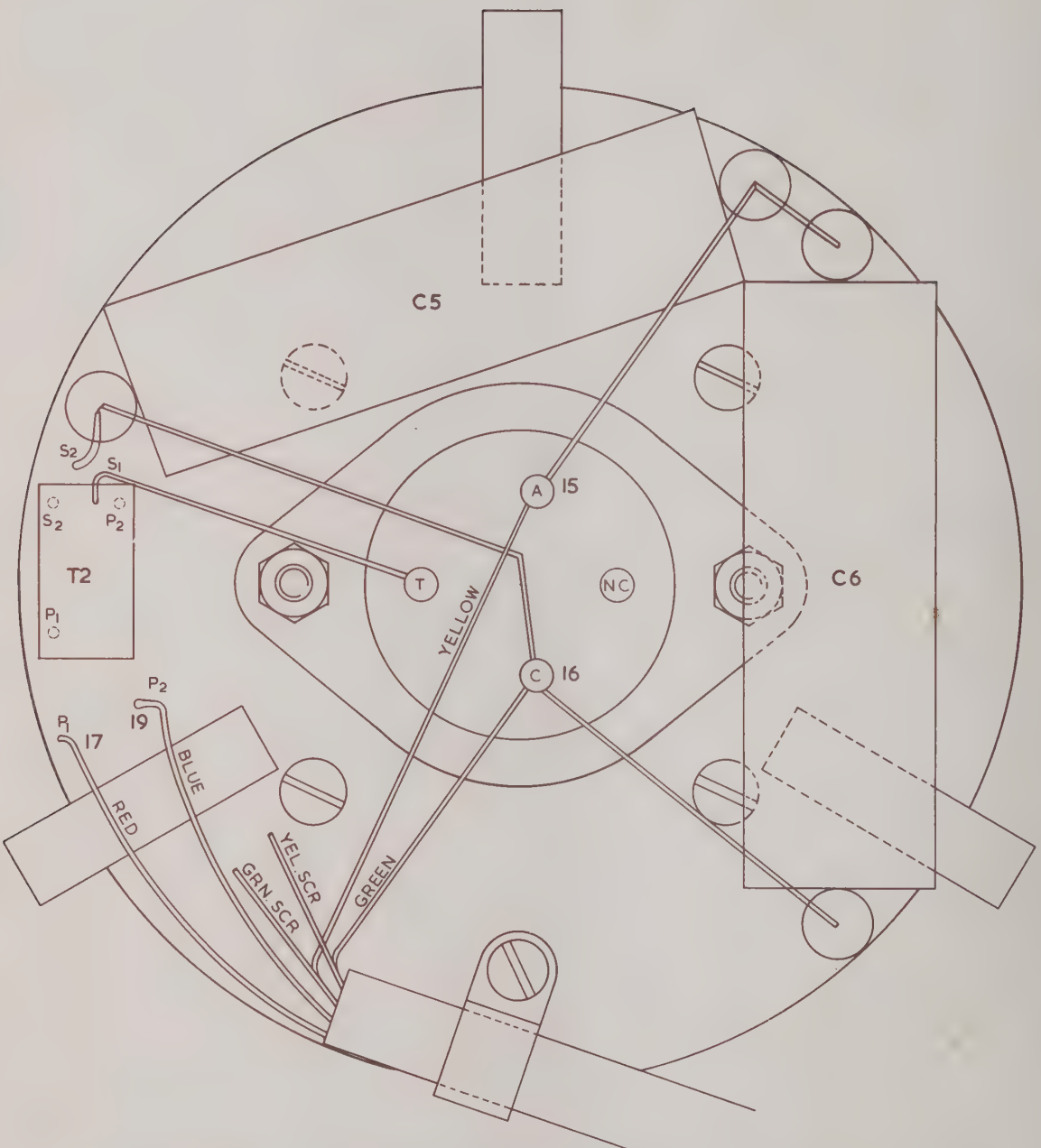
Cct. Ref.	S.E.L. Part No.	Manufacturer/Reference	Value	Tol ± %	Rating
FS1	RS 23117	Fuse, Bulgin, F286/ .750A, 750 mA, Slo-blo.			
LP1		Lamp 2.2V, 250 mA.			
V1		Flashtube, Ferranti ED90.			
-	PS 21056	Flashtube Socket, McMurdo, SP5/E			
-	C 27569	Lens, (V1) 18 oz Glass.			
-	LS 16745	Coiled, Extendable Cord, 30in. Rist.			
-	-	Mains Cable, 3-Core, 24/0.2, PVC Grey H/D Radio Spares.			
-	-	Transistor, Mounting Pad, Milton Ross 10218.			
-	-	Transistor, Mounting Pad, Milton Ross 10358.			



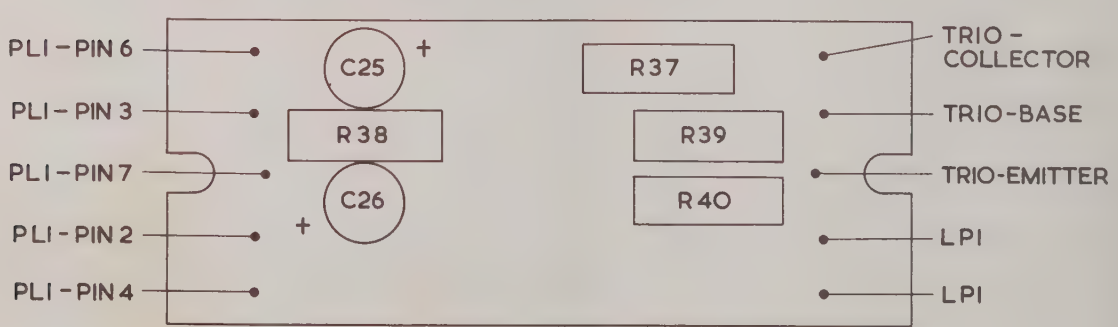
P. C. BOARD No. 1 – COMPONENT LAYOUT B40020 FIG. 1



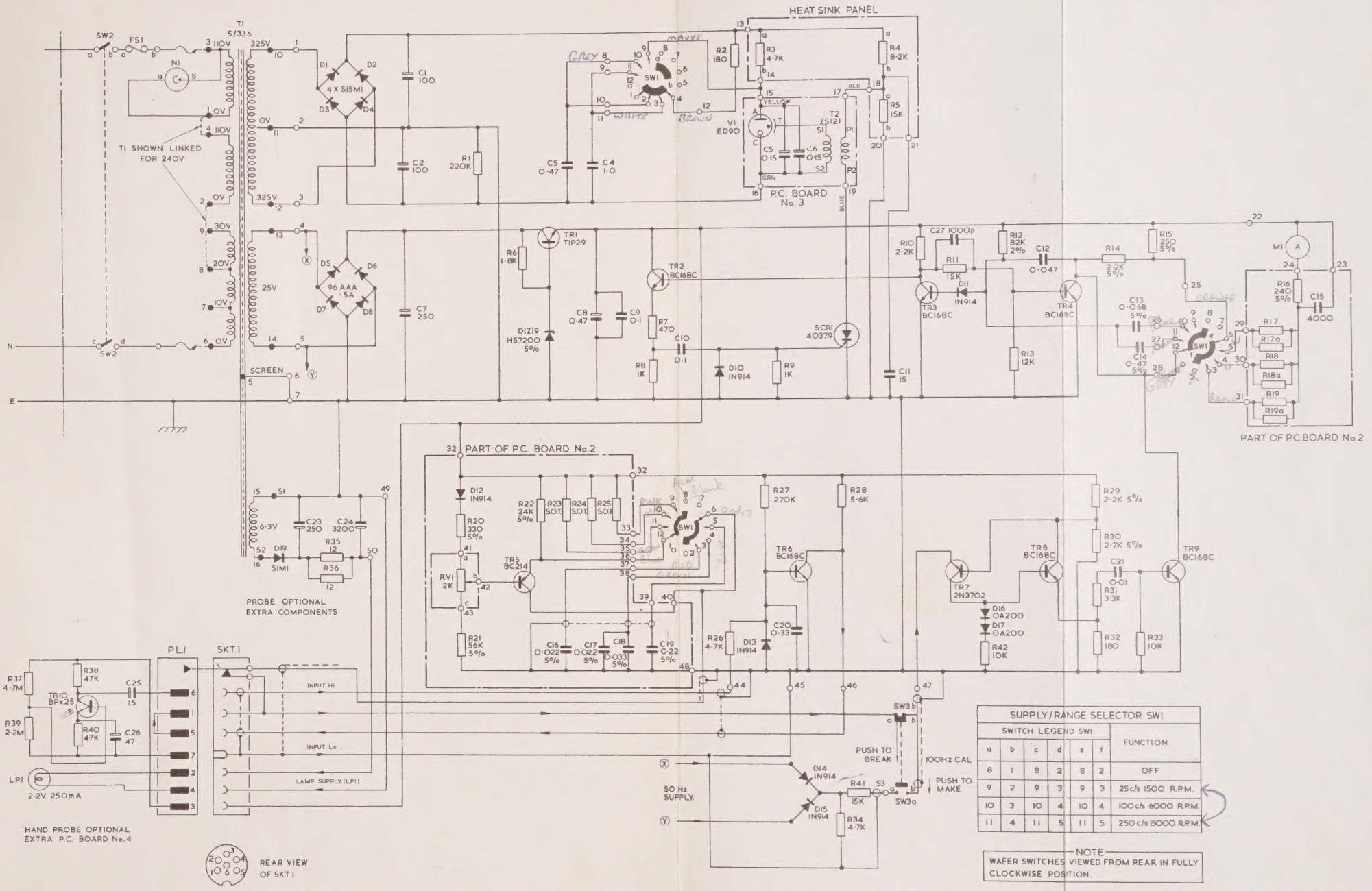
P. C. BOARD No. 2 – COMPONENT LAYOUT D 40021 FIG. 2



P.C. BOARD No.3-COMPONENT LAYOUT D 27507 FIG 3



P.C. BOARD No.4-COMPONENT LAYOUT D 27509 FIG. 4



STROBOSCOPE SM8 – CIRCUIT DIAGRAM E26340 FIG. 5

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